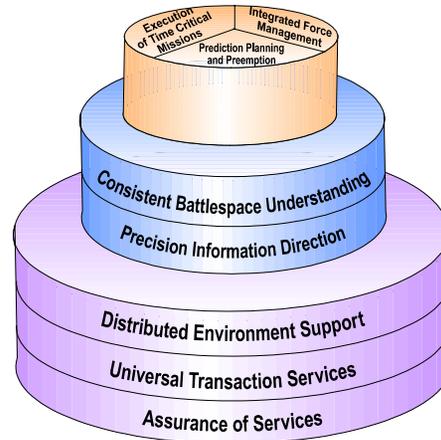
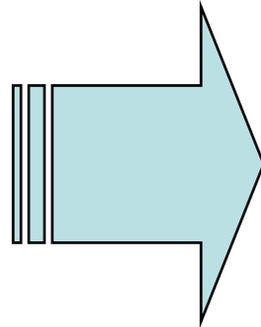


Warfighter's M&S Needs

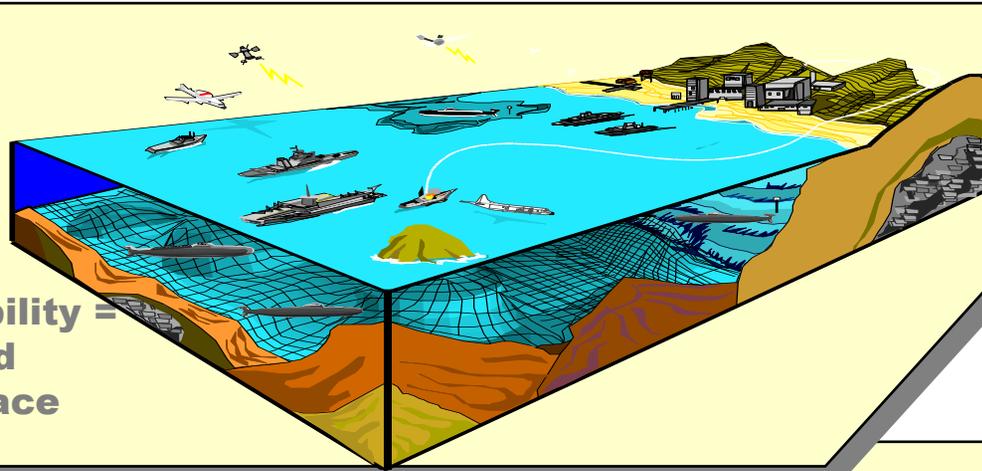


CINC Needs (WARMOND Data Base)

- **Link to C4I systems (w/reach-back)**
- **Faster, less costly database development**
- **Standardized (reusable) components**
- **Reduced overhead**
- **Operational data collection**
- **Access to terrain for operational areas**
- **Tools for operational decision-making**
- **Improved human performance modeling**

“How the Pieces Fit”

**Desired Capability =
Simulated
Mission Space**



ENGINEERING MODELS **SIMULATORS** **SYSTEM TESTBEDS**
BATTLE LABS

GLOBAL GRID

**NATIONAL INFORMATION
INFRASTRUCTURE**

ACTDS

**WARGAMING
CENTERS**

C4I
**DSI /
DISN
LES
GCCS**

Comm Connectivity

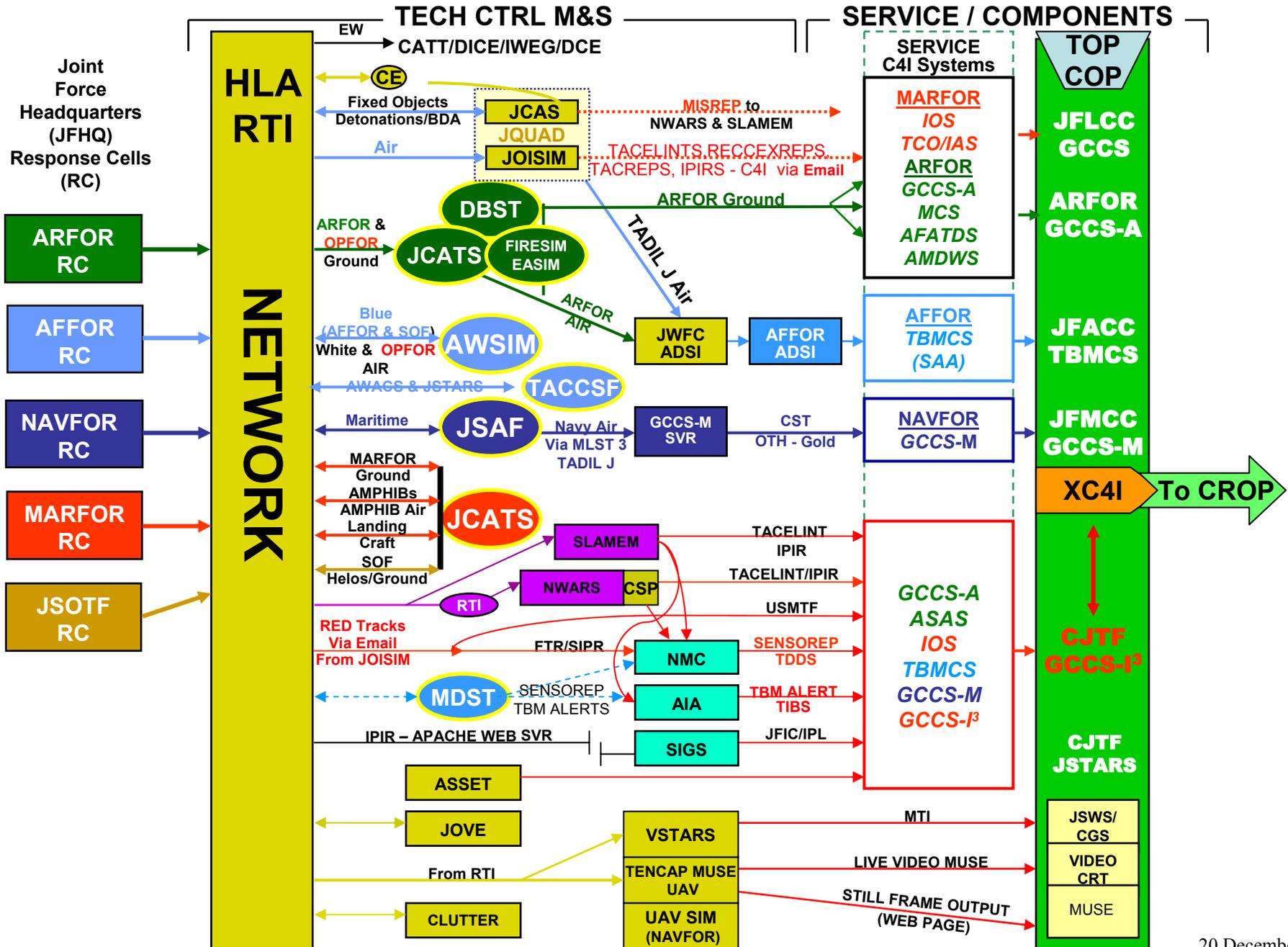


⌘ **POLICY & DIRECTIVES**
⌘ **COMMON TECHNICAL FRAMEWORKS**
⌘ **PROTOCOLS & STANDARDS**

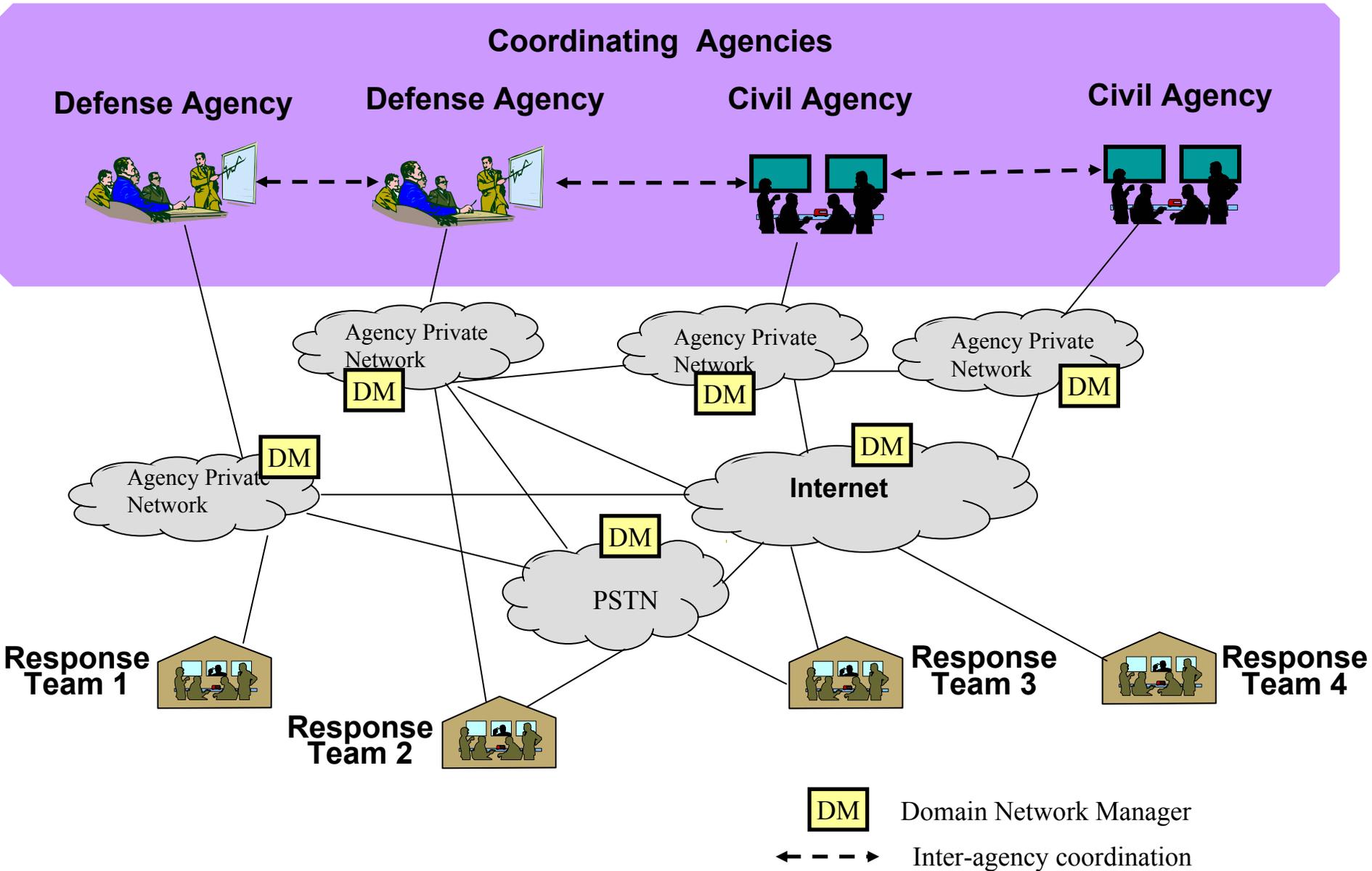
⌘ **COMMON REPRESENTATIONS**
⌘ **COMMON SERVICES**
⌘ **CONFORMANCE**

Interoperability & Reuse

MC02 M&S/C4I Simulation Data Flow



Assured Communications in HLS



Issues in Networking for M&S

Critical Factors:

- Latency: how to predict and control it across networks with radically different bandwidths
- Quality of service: do we know how to specify it well enough
- Protocols: currently simulations use UDP and not TCPIP, is this a problem for networks with heterogeneous components and firewalls
- MLS: multi-level security operation, will the political and technical worlds ever converge on solutions
- Sharing networks: managing tactical systems and simulations both of which tend to want to control the network operations

Networking Research Areas

Networking technology solutions that scale to:

- Thousands of multicast groups with hundreds of join/leaves per second:
 - this is the scale of a large military activity
- Many-to-many multicasting for tens of thousands of simulations
 - inherent requirement of distributed simulation on the scale of large military activities
 - recently IETF multicast development has been focused on one-to-many delivery (easier to do, more common problem - but bad news for DMSO)
- Mix of reliable and best-effort multicast traffic
 - much of the simulation state data is redundant
 - too expensive to send it over and over- we need real-time reliable multicast for this part of the traffic
- Qos desirability but no commercial , or perhaps gov't incentive
 - Lower bounds of reliability across multiple network domains
 - Latency requirements
 - Trusted laboratory with collaboration between industry, gov't and researchers

What to Do

- Virtual IETF
- Requirements Driven HLS Research Plan based on M&S
- Wireless Modeling – fill out holes in capability
- Untethered devices
- Model GIG
- Security and Hacking by logical disconnects